

Response After Final
Application No. 10/051,158
Attorney Docket No. 020062

REMARKS

Claims 3, 6 and 13-15 are pending in the present application. No amendment has been proposed. It is respectfully submitted that this Amendment is fully responsive to the Office Action dated February 8, 2006.

Allowable Subject Matter:

Applicants gratefully acknowledge the indication that claim 14 has been allowed.

As to the Merits:

As to the merits of this case, the Examiner relies on the newly cited reference of Nakamura (U.S. Patent No. 6,472,761) in setting forth the following rejection:

Claims 3, 6, 13 and 15 stand rejected under 35 USC §102(e) as being anticipated by Nakamura.

Each of these rejections is respectfully traversed.

(1) Concerning the technical content of the present Invention

1) The invention relates to solid-state image pickup apparatus packaging a solid-state image pickup device chip in CSP (Chip Size Package), and more particularly to the hermetic seal portion thereof. The technical content of claims 3 and 13, as discussed in the Amendment filed November 14, 2005, is repeated below.

The frame portion of a hermetic seal portion of the solid-state image pickup apparatus according to claim 3 at least includes: a metal wiring; a bump formed on solid-state image pickup device chip and electrically connected to the metal wiring; a frame base portion having the metal wiring formed on one surface thereof and adhered at the other surface thereof to a flat-plate portion; and a sealed region for sealing the periphery of the bump by a sealing material.

Further, the flat-plate portion is formed as having substantially the same size as the solid-state image pickup device chip and the frame portion is formed so that it does not jut out from the flat-plate portion to thereby construct a solid-state image pickup apparatus in CSP form having substantially an equivalent size as the device chip where edge sides of the solid-state image pickup device chip and those of the hermetic seal portion are caused to substantially coincide. In other words, the edge sides of the flat-plate portion, frame portion and solid-state image pickup device are made substantially identical.

In this manner, the solid-state image pickup apparatus according to claim 3 is characterized in construction of the frame portion of the hermetic seal portion so that: a hermetic seal portion with an increased strength and high reliability can be obtained; a small-size packaging is feasible; an improved throughput is achieved; and an electrical connection with an external section is made easier.

2) The solid-state image pickup apparatus according to claim 13 has a hermetic seal portion comprising: a flat-plate portion formed of a transparent member; and a frame portion at least including a metal wiring disposed on a side portion of a lower surface of the flat-plate portion, a bump formed on solid-state image pickup device chip and electrically connected to the metal wiring, and a sealed region for sealing the periphery of the bump by a sealing material; wherein edge sides of the solid-state image pickup device chip and those of the hermetic seal portion are caused to substantially coincide, and a wiring region or an electrode pad region is formed from an electrode pad provided on the solid-state image pickup device chip via the bump and metal wiring to a side surface or to a back surface through a side surface of the solid-state image pickup device chip so that an external terminal can be electrically connected to the wiring region or the electrode pad region.

With such construction, an optimal electrical connection structure to an external terminal is provided from the electrode pad of the solid-state image pickup device chip through the metal

wiring formed on a side surface or the side surface and back surface of the solid-state image pickup device chip in a solid-state image pickup apparatus in CSP form having an equivalent size as the solid-state image pickup device chip. And it can be applied to various small-size packaging where, for example, a direct mounting of chip size solid-state image pickup apparatus onto a circuit board having a signal processing circuit, etc., formed thereon is made feasible.

(2) Concerning Cited Reference

By contrast, newly cited Nakamura (U.S. 6,472,761) relates to solid-state image pickup apparatus using Face-down bonding, where a transparent substrate 10 and solid-state image pickup device 20 are subjected to face-down bonding. The transparent substrate 10 is further electrically jointed to a print board 30 of LCC (Leadless Chip Carrier) structure having a frame aperture 31, and the solid-state image pickup device 20 is jointed thereto in a hermetically sealed manner by means of thermosetting resin 40. The electrical connection to an external section of the solid-state image pickup apparatus is then effected through LCC terminal formed on the print board 30.

More particularly, the solid-state image pickup device 20 having first projecting electrodes 21 formed on electric signal I/O terminals 22 is face-down bonded to the transparent substrate 10 having projection electrode connection electrode terminals 11 serving as an inner wiring metal layer and an electrode terminal group 12 which is externally formed so as to output

an electric signal to the outside. The projection electrode connection electrode terminals 11 and the electric signal I/O terminals 22 are thereby electrically connected to each other through the first projecting electrodes 21, that is, the transparent substrate 10 and solid-state image pickup device 20 are electrically connected to each other.

Further second projecting electrodes 14 are formed on the electrode terminal group 12 in the transparent substrate 10. A print board 30 having a frame aperture 31 in the size of the solid-state image pickup device 20 is then electrically jointed to the transparent substrate 10 through the second projecting electrodes 14, and the solid-state image pickup device 20 is jointed thereto in a hermetically sealed manner by means of the thermosetting resin 40.

Here the print board 30 is formed of a lattice frame 32 having LCC structure, and a non-pin type lead terminal 33 covering the outside of the lattice frame 32 is to be connected to the electric signal I/O terminals 22 on the solid-state image pickup device 20 through the second projecting electrodes 14, electrode terminal group 12, projection electrode connection electrode terminals 11, and first projecting electrodes 21.

Further a device fillet 43 is formed between the print board 30 and the solid-state image pickup device 20, and a substrate fillet 44 is formed between the print board 30 and the

transparent substrate 10. These fillets represent an adhesive portion, i.e., the adhesive itself for filling a corner or angular portion formed at places where two members are bonded to each other.

(3) Contrast between the Invention in this case and Cited Nakamura

1) In summarizing the difference between the invention of the present case and cited Nakamura, first of all, the two are greatly different from each other in the manner of packaging.

In particular, the Invention relates to CSP for achieving a size substantially equivalent to device chip.

In Nakamura, on the other hand, after connecting the solid-state image pickup device 20 to the transparent substrate 10 by means of face-down bonding, the transparent substrate 10 to which the solid-state image pickup device 20 is connected as described is further disposed within a frame aperture 31 of the print board 30 which has larger outer dimensions than the solid-state image pickup device 20 so as to connect the transparent substrate 10 and the print board 30 to each other.

The present Invention and Nakamura are thus totally different from each other in the manner of packaging. No disclosure or suggestion has been made at all in Nakamura with respect to the above described technical content according to the invention of the present case.

2) A description will now be given in detail with respect to the difference between the invention according to claim 3 of the present case and Nakamura.

In the solid-state image pickup apparatus according to claim 3 of the present case, the frame portion of the hermetic seal portion is formed on a side portion of a lower surface of the flat-plate portion and on the solid-state image pickup device chip, and includes at least a metal wiring, bump, frame base portion, and sealed region. Further the flat-plate portion and the solid-state image pickup device chip have substantially the same size, and edge sides of the hermetic seal portion and the solid-state image pickup device chip are being coincident.

In Nakamura, on the other hand, the hermetic seal portion is formed in a manner bulging out from the solid-state image pickup device chip instead of residing on the solid-state image pickup device chip, though it is formed on a side portion of a lower surface of the transparent substrate 10 which is a flat-plate portion. In other words, the one disclosed in Nakamura has the flat-plate portion and the solid-state image pickup device chip that are different in size from each other, and it is not of CSP structure where, as in the invention of the present application, the edge sides of the hermetic seal portion and the solid-state image pickup device chip are being coincident.

The frame portion in Nakamura as pointed out by the Examiner is the print board 30 of LCC structure which is formed of lattice frame 32. The print board 30 is a base board for providing an electrical connection to an external terminal with providing a frame aperture thereof for mounting the transparent substrate 10 to which the solid-state image pickup device 20 is connected. It is disposed around the solid-state image pickup device chip so as to surround the chip. For this reason, it cannot be said that the print board has an equivalent size as the solid-state image pickup device chip. The print board is obviously larger.

Accordingly, the frame portion (lattice frame 32) in Nakamura pointed out by the Examiner, unlike the one in the invention of the present application, is not formed on the solid-state image pickup device chip. It does not correspond to and is totally different in construction from the frame portion in the Invention. Further a print board is not used in the solid-state image pickup apparatus according to the Invention. Furthermore, although it can be said that the frame portion in Nakamura as pointed out by the Examiner has its edge sides coinciding those of the transparent substrate 10, the edge sides of the frame portion and the solid-state image pickup device chip are not being coincident.

Moreover, the frame base portion 21 in the invention of the present application is one of the constructional components for constituting the hermetic seal portion to be formed over the

solid-state image pickup device chip 1. The frame base portion has one face on which a metal wiring 7 is formed, and the other face thereof is adhered to the flat-plate portion 5.

The frame base portion in Nakamura as pointed out by the Examiner, on the other hand, refers to the substrate fillet 44. The substrate fillet 44 represents a portion of the thermosetting resin 40, i.e., the resin itself serving as an adhesive that to some extent covers a side surface of the print board 30. The thermosetting resin 40 is provided to improve bonding strength. It naturally does not correspond to the frame base portion of the invention of the present application or to a sealing material 8 to be formed on the solid-state image pickup device chip of the Invention.

In other words, the substrate fillet 44 of Nakamura, though it is formed on a side portion of a lower surface of the flat-plate portion, is not formed on the solid-state image pickup device chip; it refers to an adhesive and obviously does not correspond to the frame base portion which, as in the invention of the present application, is a part of hermetic seal portion to be formed over the solid-state image pickup device chip.

As the above, the invention according to claim 3 of the present case and the one disclosed in Nakamura are totally different from each other in the manner of packaging and in construction

of the hermetic seal portion. The construction featuring claim 3 of the present case is neither disclosed nor suggested at all in Nakamura.

3) A detailed description will now be given with respect to the difference between the invention according to claim 13 of the present case and Nakamura.

As previously described, the solid-state image pickup apparatus according to claim 13 of the present case relates to CSP. In particular, as shown in Fig.9, a wiring region 13 is formed from bump 6 on the solid-state image pickup device chip 1 via the metal wiring 7 to a side surface of the chip 1 or to a back surface of the chip 1 so that an external terminal can be electrically connected to the wiring region 13.

Thus, in the solid-state image pickup apparatus according to claim 13 of the present case, a wiring region is formed to a side surface or to a back surface of the solid-state image pickup device chip itself so as to achieve a small-size packaging with dimensions unchanged from chip size where the edge sides of the solid-state image pickup device chip and of the hermetic seal portion are substantially being coincident.

As previously described, Nakamura, on the other hand, first of all, is not of CSP packaging where for example the edge sides of the hermetic seal portion and the solid-state

image pickup device chip are being coincident. In Nakamura, the solid-state image pickup device chip is mounted on the transparent substrate 10 by means of face-down bonding, and these are further mounted in aperture 31 of the print board 30. The lead terminal 33 serving as a wiring region is then formed in a manner extended from a side surface to a back surface of the print board 30. In other words, the wiring region to which an external terminal can be connected is not formed on the solid-state image pickup device chip itself but instead it is formed on the print board 30 that mounts the solid-state image pickup device chip. A form of packaging kept in chip size is not achieved.

Accordingly, the above described construction featuring claim 13 of the present case is neither disclosed nor suggested at all in Nakamura.

4) Claims 6 and 15 are dependent claims respectively of claims 3 and 13. Since the solid-state image pickup apparatus according to claims 3 and 13 are different from the one disclosed in Nakamura as described above and are fully patentable, claims 6 and 15 depending thereon are believed to be also fully patentable.

In view of the aforementioned remarks, Applicants submit that that the claims are in condition for allowance. Applicants request such action at an early date.

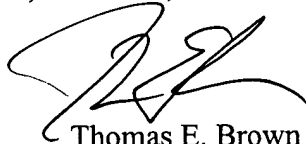
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If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP

A handwritten signature in black ink, appearing to read 'TEB', with a stylized flourish at the end.

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